have had considerable attraction for Duhem. On the origins of statics he published two volumes, but the crowning work of Duhem's later years would appear to be a work of ten volumes on the history of astronomy up to Copernicus, of which so far only four have appeared.

The writer of this notice visited Duhem at Bordeaux in 1901. He was a shortish man with a very pleasing manner, in which could be observed that element of preciseness which characterises his writings. It will readily be understood that a vast laboratory fitted with costly and complicated apparatus was not needed by a mathematical physicist like Duhem, and it was interesting to compare the simple equipments at Bordeaux with the rather less simple, but more dusty, pieces of apparatus used by another mathematical physicist, Ludwig Boltzmann, at the dingy buildings in the Türkenstrasse at Vienna. But if Duhem did not indulge in superfluous luxuries, he made the best use possible of all the essential apparatus, and on the occasion of the visit he demonstrated the then newly discovered properties of radio-active substances with the same care and attention to detail that are so noticeable in his theories.

If Duhem did not concentrate his main efforts on the discovery of new phenomena or the measurement and re-measurement of physical constants, he has at least played an equally important part in the advancement of our knowledge by evolving order out of chaos, and uniting isolated portions of mathematical physics in the form of a connected and logical theory.

G. H. BRYAN.

NOTES.

A MEETING to consider the steps to be taken to raise a memorial to the late Sir William Ramsay will be held at University College, London, on Tuesday, October 31, at 4.30 p.m. Invitations will be sent out on or about October 20. It will, however, greatly help in making the arrangements if all persons wishing to be present, including in particular scientific friends and former students of Sir William Ramsay, will send a postcard to the secretary, University College, London, intimating their desire. Those who thus apply will not be asked to reply to the invitation when issued. Further particulars of the arrangements for the meeting will be issued in a few days. After the meeting the director of the University College Chemical Laboratories, Prof. J. Norman Collie, will deliver a memorial lecture on "The Scientific Work of Sir William Ramsay," at 5.30 p.m.

THE annual Huxley Memorial Lecture of the Royal Anthropological Institute will be delivered on Tuesday, November 14, by Sir J. G. Frazer; the title of the lecture is "Ancient Stories of a Great Flood."

MR. H. G. NAGEL and Mr. A. D. Hall have been appointed members of the Government committee which is considering the question of the teaching of science.

WE learn through the *Electrical Review* that it has been decided, owing to the war, not to hold the Hobart meeting of the Australasian Association for the Advancement of Science, which had been arranged for January, 1917.

THE meetings of the London Mathematical Society will be held during the session 1916–17 in the rooms of the Royal Astronomical Society, Burlington House, W. They will not always be on the second Thursday of each month, as hitherto, but on dates and days announced by the council in the list just issued.

THE twenty-fourth "James Forrest" lecture of the Institution of Civil Engineers will be delivered on Tuesday, October 24, at 5.30 p.m., by Sir John Purser Griffith. The subject will be "The Development of Appliances for Handling Raw Materials and Merchandise at Ports and other Large Centres of Traffic."

THE death is recorded in the *Revue Scientifique* of Dr. Valentin J. J. Magnan, a leading French authority on mental disorders. Dr. Magnan was elected a member of the Paris Académie de Médecine in 1893, and became president in 1915. He was the author of "Leçons cliniques sur les Maladies mentales."

THE death is announced in action on September 28 of Capt. E. J. Smith, Duke of Wellington's Regiment. Before joining the forces, at the outbreak of war, he was senior science master at Sexey's School, Blackford, Cheddar. While in Gallipoli he was shot through the shoulder when in command of the snipers of his battalion. Later he commanded the Brigade Bombing School at Suvla Bay.

THE Hippurite from the chalk near Faversham, noticed in our last issue, has now been placed, with some other illustrative specimens, on exhibition in the Gallery of Fossil Reptiles at the Natural History Museum, since the galleries containing fossil invertebrates are closed to the public.

REPORTS from the Swedish expedition to Spitsbergen, noticed in NATURE for July 27 (p. 448), show that valuable work has been done, especially in the detailed mapping of the district. Besides conducting the investigations previously mentioned, the expedition has made several excavations in the old moraines on the shore, resulting in the discovery of deep-seated ice, many thousands of years old. How thick a covering of rock such fossil ice can support is a question worth solving. At any rate, deep borings have proved that it does not continue under the floor of the harbour. A Norwegian expedition to Spitsbergen, which has been investigating the Svalbard Company's coalfield, reports that it is of colossal size, containing, according to calculation, as many as 880 million tons. Norway's yearly consumption of coal is 2·8 million tons.

REPLYING, in the House of Commons, to a question by Mr. Ashley, M.P., on October 12, Mr. McKinnon Wood said:—"The direct savings resulting from closing the national museums and picture galleries to the public are estimated at approximately 50,000*l.* per annum, in addition to which a large economy results from freeing staffs, and in several cases accommodation, for purposes of immediate national importance at the present time." The sum named is that which was put forward by the Government when the proposal was first mooted, and, relatively small though it be, it is satisfactory to learn that this regrettable step has actually resulted in such direct addition to the National Exchequer. It must not, however, be forgotten that the museums in question had already forgone their purchase grants and had in other directions greatly reduced their expenditure, while continuing to perform, as exemplified in our last issue, important national services. It would be interesting to compare the actual expenditure on museum work at the present time with the pre-war expenditure. In such a comparison the salaries of all employees now on war service would, of course, be deducted.

DR. J. S. FLETT, F.R.S., will deliver the Swiney lectures this year. The subject selected by the trustees of the British Museum, "The Mineral Resources of Europe," is very appropriate to the circumstances of the time. The lectures, twelve in number, will be delivered in the hall of the Royal Society of Arts, commencing on November 14. Dr. Flett will deal with the coal resources, petroleum, iron ores, copper, tin, lead, and the precious metals of all the European countries, and one lecture will be devoted to the salt deposits of Germany, France, and Great Britain, and to a general review of the mineral resources of the countries of Europe, and their importance in the world's trade and industry.

A REMARKABLY fine skull of the Cretaceous horned dinosaur, Monoclonius, has just been added to the remains of fossil reptiles exhibited in the Geological Department of the British Museum (Natural History). The specimen, which measures nearly 5 ft. in length, was discovered by Mr. W. E. Cutler in the Belly River formation of Alberta, Canada, and is interesting for comparison with the still larger skull of Triceratops from Wyoming, U.S.A., already in the museum. Monoclonius is peculiar in having the largest horn on the nose, only diminutive horns above the eyes, while its extensive bony frill over the neck is pierced by two vacuities and provided behind with a pair of remarkable forwardly directed prominences. The brain-case of the fossil is especially well preserved, and a plaster cast of the cavity shows the usual diminutive size of the brain.

WE regret to learn from the *Revue Scientifique* that Dr. Jean Boussac has died from wounds received in action in France. Dr. Boussac, who was born on March 19, 1885, was one of the most active and brilliant geologists of the younger French school, and had done much important work for the Geological Survey of France. He was especially interested in the Eocene Nummulitic formations, and had travelled extensively in Europe and Egypt while attempting to correlate these deposits. His stratigraphical researches led to interesting results in understanding and restoring the oceanography of Eocene times. He also undertook a revision of the species of Nummulites to facilitate their use in geological work, and made many valuable observations on the evolution of the shells of the Cerithiidæ. All Dr. Boussac's researches were characterised by marked originality, and his death causes a serious loss to geological science.

THE Norwegian explorer, Dr. Carl Lumholtz, has recently returned from a prolonged journey in the heart of Borneo. From the *Daily Chronicle* we learn some details of his work. After spending two months among the Murang Dyaks, he started on his journey to central Borneo in December, 1915. The route was from Banjermassin up the Barito and the Busang to the Müller mountains, thence by the Mahakkan river back to the coast. Dr. Lumholtz's work includes a new map of the watershed region of central Borneo and anthropological and photographic records of the Dyaks of the Upper Mahakkan. He has also brought back large ethnographical and zoological collections. The expedition reached Samarinda on August 22 this year.

A NEW expedition to tropical South America is announced by Dr. Hamilton Rice. In the *Geographical Journal* for October (vol. xlviii., No. 4) Dr. Rice says that he proposes to leave New York this month for Brazil, and to ascend the Amazon and Rio Negro to Santa Isabel, pushing on thence by steam launch to the Guainia. He hopes to reach the sources of the Guainia, which lies between the Papunaua branch of the Inirida and the Isana. Further, he proposes to survey and map the Casiquiari, which links the basins of the Orinoco and Amazon, and to solve some of the hydrographical problems of this region. Dr. Rice hopes to determine some longitudes with the help of wireless telegraphy, and to effect barometric determinations of altitude which will form the basis for a more accurate knowledge of the hypsometry of this part of South America than exists at present.

PROF. VINZENZ CZERNY, news of whose death, at seventy-four years of age, was received last week, was professor of surgery at Heidelberg University, and director of the Institute for Cancer Research in the same town. At the commencement of his career he showed for the first time that normal life was possible after extirpation of the stomach by operations on two dogs, one of which was alive and well five years later. Apart from his eminence as a surgeon, he will chiefly be remembered by his exertions in founding the Institute for Cancer Research at Heidelberg, of which he was the first director, a task to which he brought all the energies of an enthusiastic and generous personality. He was president of the International Conference on Cancer Research held in Paris in 1910, under the patronage of the President of the French Republic.

BY the death, in Edinburgh, of Dr. James Burgess, at the age of eighty-four, India has lost a veteran archæologist. Arriving in India before the Mutiny days, he was engaged in educational work at Calcutta and Bombay. But his bent for archæology led him to found the *Indian Antiquary,* which, since 1872, has taken a leading part in antiquarian and linguistic research. In 1874 he was placed in charge of the Archæological Survey of Western India, and at the close of his official career he had held for three years the post of director of the Archæological Survey of India. His original work was chiefly confined to his careful survey of the antiquities of Gujarat, and he published useful monographs on Elephanta, Somanath, Junagadh, and Girnar. He was closely associated with the great architect and antiquary, James Fergusson, and collaborated with him in the work on the "Cave Temples of India." It was near the close of his literary career that he undertook a new edition of Fergusson's standard "History of Indian and Eastern Architecture," with somewhat disappointing results. It is on his work as a careful and energetic field-worker in the survey of Indian antiquities that his reputation mainly depends.

THE death on September 11, at the age of twenty-five, of Second-Lieut. Archibald W. R. Don, while on active service abroad, deprives the scientific world of one who showed exceptional promise. He was the fourth son of Mr. and Mrs. R. B. Don, of Tealing House, Forfarshire, and The Lodge, Broughty Ferry. Educated at Winchester and Trinity College, Cambridge, he won a major scholarship at the latter, and graduated first class in the Natural Sciences Tripos in 1912. He was much loved and respected in a wide circle of undergraduates and senior members of the University, where his great influence was ever exerted for good. He devoted his attention to geology early in life, but determined to follow the profession of medicine, and after leaving Cambridge entered at St. Bartholomew's Hospital. He intended, however, to pursue the study of his favourite science during his leisure hours, and had already written, with Dr. G. Hickling, a paper on the problematical *Parka decipiens*, which was read before the Geological Society, but is not yet published. He obtained a commission in the Black Watch in December, 1914, and while on service at home and abroad collected geological specimens for the Sedgwick Museum.

THE council of the Chemical Society has arranged for three lectures to be delivered at the ordinary scientific meetings during the session 1916–17. The first of these lectures, entitled "Alloys of Copper and Tin, Aluminium and Gold," will be delivered on January 18 by Col. C. T. Heycock, F.R.S. On March 15 Dr. Horace T. Brown, F.R.S., will lecture on "The Principles of Diffusion: their Analogies and Applications"; and the third lecture, entitled "Some Main Lines of Advance in the Domain of Modern Analytical Chemistry," will be given on May 17 by Mr. A. Chaston Chapman. The ordinary scientific meetings commence at 8 p.m. In order to afford facilities to fellows for meeting each other informally, the council has again arranged to hold three informal meetings during the session, on October 19, 1916, and on January 11 and May 10, 1917. The council will gladly welcome any offers of assistance from fellows willing to show experiments and apparatus at these meetings, and such offers should be made to the assistant secretary not later than the Monday previous to the meeting.

THE gift of the Wright aeronautical patents to the British nation has caused some comment in the Press. Without in any way underestimating the magnificent pioneer work of the brothers Wright, it must be admitted that the majority of the ideas covered by their patents are now out of date. One of the main patents is connected with the warping of the wings, and the interconnection of the warp and rudder controls. At the present time warping has been almost entirely superseded by the use of wing flaps, which are more effective aerodynamically, besides being much easier to design from a mechanical point of view. Patents connected with automatic stabilisers are also useless, for machines can now be built which are inherently stable, both longitudinally and laterally, so that the necessity of an automatic stabiliser is removed. The Wrights themselves seemed to think that such a stabiliser was unnecessary. The action of the Wright Company in accepting 15,000*l*. compensation instead of proceeding with their action against the War Office for infringement was highly laudable at a time when the co-operation of all aeronautical firms was so much needed. It seems doubtful, however, whether the gift of their patents to the nation will produce any great benefit at the present stage of the development of aeronautics

THE thirteenth memorandum of the Health of Munition Workers Committee, which has just been issued, deals with juvenile employment. It is pointed out that the hours of work are extremely long—sixty hours a week—and that in many cases this limit has been exceeded, and the weekly hours have been extended to sixty-seven hours, or even longer. The long hours of work react unfavourably on the health of the workers, not only owing to the physical strain involved in the work, but also because the limited opportunities for recreation often lead to deterioration of character. These harmful effects are clearly more liable to occur in the young, whose development is still incomplete and whose character is not yet formed and stable. The committee recommends the abolition of Sunday work, and, except in special circumstances, of night work. It does not feel justified, however, under the present conditions, in suggesting the limitation of the hours of work to less than sixty hours weekly for those under sixteen, and sixty-five hours for those above sixteen years of age. A further excellent suggestion is the appointment of visitors, whose work is directed to improving the physical and moral welfare of the boys in factories by organising facilities for recreation, by personal supervision, and by direct association with the boys; this plan has already been adopted in at least one factory.

THE Secretary of State for India has authorised the Indian Committee of the Imperial Institute to inquire into and report on the possibilities of extending further the industrial and commercial utilisation of Indian raw materials in this country and elsewhere in the Empire. The committee has already commenced its work and has appointed a number of sub-committees to deal with the more important groups of materials, to consider the results of investigations and inquiries already conducted by the Imperial Institute, and to obtain the views of leading merchants, manufacturers, and other users of the raw products of India. One of the important aspects of the committee's work will be to suggest openings for the employment of those Indian materials which before the war went to enemy countries. The Indian Committee of the Imperial Institute includes Lord Islington (Under-Secretary of State for India), Sir Marshall Reid (member of the India Council), Prof. Wyndham Dunstan (director of the Imperial Institute), Mr. L. J. Kershaw (secretary, Revenue and Statistical Department, India Office), Sir John Hewett (formerly Lieutenant-Governor of the United Provinces), Mr. G. B. Allen (of Messrs. Allen Bros. and Co. and Messrs. Cooper Allen, Cawnpore), Mr. Yusuf Ali (late Indian Civil Service), Sir R. W. Carlyle (lately member of the Viceroy's Council), and Sir J. Dunlop Smith. Mr. C. C. McLeod, chairman of the London Jute Association, is chairman of the committee, and the secretary is Mr. A. J. Hedgeland, of the Imperial Institute.

MR. F. R. ROWLEY, the curator of the Royal Albert Museum, Exeter, has contributed some valuable notes to the *Museums Journal* for October on objects preserved in arsenious acid glycerine jelly. His method is an adaptation of, and an improvement on, that devised by Prof. Delépine. The advantage of this method of preservation is purely one of convenience, since it affords a means of avoiding the introduction of spirit, or other fluid preservative, among dry preparations. The successful preservation of colour varies according to circumstances, but experiments with seaweeds have given extremely satisfactory results. So far, however, this medium has failed in regard to flowers.

THE relationship between the geographical distribution of megalithic monuments and ancient mines is discussed at length in an able essay by Mr. W. J. Perry in the Memoirs and Proceedings of the Manchester Literary and Philosophical Society, 1915–16. The author contends that the weaving of linen, the use of pearls, precious stones and metals, and of conch-shell trumpets, are all accompaniments of the megalithic culture, which had its origin in Egypt. Thence it spread through Europe to Britain, on one hand, and eastward through India and the East Indian Archipelago, and thence out across the Pacific by way of the Carolines, Solomons, New Hebrides, Fiji, and Easter Island to America. The agents in this distribution were the Phœnicians, and the part they played in this is discussed at length by Prof. G. Elliot Smith in an appendix to Mr. Perry's paper. Herein evidence, which seems to be beyond dispute, is produced to show that the Phœnicians played the part of distributing agents of this culture, and not that of missionaries. The search for wealth was the underlying factor in this distribution, and provided the motive for the widespread travellings of these people. To assist in this search they employed expert gold-miners from the Black Sea and from Colchis, hence the megalithic monuments in the mining camps. That these two contributions will give rise to much discussion in the immediate future need scarcely be said, for the theme is one of first-rate importance; but there can be little doubt that the views they have so skilfully expressed will meet with general acceptance.

SPORADIC migrations of butterflies, moths, and dragonflies have long been known, and have generally been regarded as comparable to the similar migrations of locusts. But Mr. Howard J. Shannon, in the *Scientific Monthly* for September, under the title "Insect Migrations as Related to Those of Birds," has marshalled a host of facts which apparently show that certain North American species of butterflies, diptera, and dragonflies annually migrate southwards in the autumn, following well-defined routes corresponding to those taken by the birds of the same regions. The author does no more than hint at a return migration in the spring, expressing curiosity as to whether such migrants are of the same individuals which passed southwards in the autumn, or whether they represent a new generation, bred in the southern winter quarters. Some idea of the magnitude of these migrations may be gathered from the author's statements in regard to the monarch butterflies (*Danais archippus*), which, "in mingled myriads, move forwards . . . in swarms . . . forming veritable crimson clouds . . . miles in width and streaming backwards for equal distances . . . casting below them as they go perceptible shadows."

UNDER the modest title, "Notes on Some Palæozoic Fishes," Messrs. D. M. S. Watson and Henry Day have enriched the Memoirs and Proceedings of the Manchester Literary and Philosophical Society with a contribution of first-rate importance. They have described and figured in detail the skulls of Holoptychius, Glyptopomus, and Osteolepis, and the whole fish of Rhizodopsis. These studies have shown that the Rhipidistian skull is considerably more complicated than has previously been supposed, and that the short type of paired fin found in Eusthenopteron is older than, and has given rise to, the biserial "archipterygial" fin of Holoptychius. In Rhizodopsis and Glyptopomus they have given an account of the palate which considerably extends our knowledge of the structure of this region, and has a very important bearing on the problem of Amphibian ancestry. Further, they show that Ceratodus is derived by a process of specialisation and reduction from Dipterus, while Uronemus and Ctenodus are shown to belong to different lines of descent, and the conclusion is reached that *Dipterus valencennes* is the most primitive, as it is the oldest, known Dipnoan.

DR. C. A. BARBER, sugar-cane expert to the Government of India, describes, in a recent number of the Memoirs of the Agricultural Department of India (Botanical Series, vol. viii., No. 3), some results of the work done at the Coimbatore Cane-Breeding Station since 1912, when, for the first time in India, seedling canes were raised successfully. The object of the work is to produce canes for cultivation in northern India under field conditions possible to the Indian peasant. The work is therefore limited in its objective, and is also handicapped by unsuitability of soil, insufficient chemical assistance, etc.; but in spite of these difficulties substantial progress has been made and certain provisional conclusions of general interest have been reached. Special attention may especially be directed to the various devices adopted to save labour and simplify the laborious business of selection. Arising out of this aspect of the subject, the possible correlation of morphological characters with richness of juice has been specially studied, and already Dr. Barber is able to say that "from this study it would appear that the seedlings in any general collection, with higher sucrose content, would be marked out by rather narrow, short leaves, but with a relatively high leaf module, with canes that might be thick or thin, but with a leaning towards the thin side, rather long, but not very, and with a moderately high cane module." To this rule there are, however, many and notable exceptions, particularly in the case of definite crosses. It is clear from Dr. Barber's memoir that the initial difficulties experienced at Coimbatore have been successfully overcome to a considerable extent, and the results obtained in the next few years should be of great value to the Indian sugar-cane industry, which has a great deal of leeway to make up before it reaches the level attained in other tropical sugar-producing countries, both on the scientific and the manufacturing sides.

IN a paper read before the Franklin Institute in April Mr. C. J. Gadd, chief engineer of the American Iron and Steel Manufacturing Company, directed attention to the progress which has been made recently in the application of powdered coal to the heating of furnaces for metallurgical and other purposes. If slack coal is dried, pulverised until 83 per cent. of it will pass through a sieve with 200 meshes to the inch, and delivered to the furnace in this finely divided state, its combustion is completed while it is still in suspension, and as high a temperature is attained as with producer gas. From the experience gained with the apparatus used by the American company Mr. Gadd concludes that on further development powdered coal will entirely displace oil, tar, and producer gas in the fields in which they are now supreme. The paper is reproduced in the September number of the Journal of the Franklin Institute.

SOME definite evidence regarding the cause of the accident at the new Quebec Bridge on September 11 has now reached this country, and is dealt with at considerable length by *Engineering* and the *Engineer* for October 13. The accident occurred while the central span was being raised into position, and the whole of this heavy portion of the structure fell into the river. Facilities were given to the representatives of the *Engineering News* to inspect the parts which failed, and from their report it appears that one of the four rocker bearings which supported the central span whilst in course of construction gave way when the span had been raised about 30 ft. *Engineering* hesitates to criticise, since the St. Lawrence Company had sought the advice of many able engineers, but at the same time considers that the design of the rocker bearings was very unsatisfactory in view of the immense load of 1300 tons to be imposed on each. So soon as the span was lifted there was no longer any need for rocker bearings, as each corner of the great girder was suspended from the corresponding corner of one of the cantilevers quite freely. It was only during transit on the barge that the rocker bearings could serve any purpose. Once the lifting was commenced they were superfluous, and, as the event showed, an imminent source of danger.